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Impact of a Fast Track in the Emergency Department of Martin Army Community Hospital

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This paper evaluates the impact of the recent implementation of a Fast Track system in the Emergency Department (ED) of Martin Army Community Hospital. A study was conducted to determine if a Fast Track system would reduce the Length of Stay (LOS) in the ED, reduce the number of patients who Left Without Being Seen (LWOBS), and improve patient satisfaction between December 2004 and December 2005. Data collected for the six months prior to and after the implementation of the Fast Track in June 2005 determined length of stay (LOS) were reduced by a mean of 48 minutes for non-urgent patients and 42 minutes for urgent patients. The number of LWOBS were reduced by an average of 0.85 patients per day. Patient satisfaction improved slightly during the period of investigation by 6 percent. Statistical analysis determined these results were significant for non-urgent patients $t(384) = 8.62$, $p = 0.00$ (one-tailed), urgent patients $t(384) = 5.32$ $p = 0.00$ (one-tailed), LWOBS $t(157) = 11.95$, $p = 0.00$ (one-tailed), and patient satisfaction $t(157) = -2.30$, $p = 0.01$ (one-tailed).

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Abstract

This paper evaluates the impact of the recent implementation of a Fast Track system in the Emergency Department (ED) of Martin Army Community Hospital. A study was conducted to determine if a Fast Track system would reduce the Length of Stay (LOS) in the ED, reduce the number of patients who Left Without Being Seen (LWOBS), and improve patient satisfaction between December 2004 and December 2005. Data collected for the six months prior to and after the implementation of the Fast Track in June 2005 determined length of stay (LOS) were reduced by a mean of 48 minutes for non-urgent patients and 42 minutes for urgent patients. The number of LWOBS were reduced by an average of 0.85 patients per day. Patient satisfaction improved slightly during the period of investigation by 6 percent. Statistical analysis determined these results were significant for non-urgent patients $t(384)=8.62$, $p=0.00$ (one-tailed), urgent patients $t(384)=5.32$ $p=0.00$ (one-tailed), LWOBS $t(157)=11.95$, $p=0.00$ (one-tailed), and patient satisfaction $t(157)=-2.30$, $p=0.01$ (one-tailed).

Introduction

Across the nation, both private sector and military hospital Emergency Departments (EDs) currently struggle with overcrowding. This is the result of seeing a large number of non-urgent patients. Overcrowding often results in longer wait times and increased numbers of patients Left Without Being Seen (LWOBS). Many non-urgent patients would be better served in primary care clinics but chose to visit the ED because they cannot get a primary care appointment or find the ED a more convenient avenue to receive care. Lack of access to primary care directly impacts EDs as patients unable to get appointments seek treatment in the ED. Private Sector emergency departments also contend with the increasing number of uninsured and underinsured for which the ED is the only place to seek care as hospitals are legally and ethically bound to treat them. Military hospitals are largely unaffected by lack of insurance among beneficiaries as most of their health care facilities have restricted access on military bases and are largely not accessible by non-beneficiaries.

The purpose of this study was to improve patient care by reducing the Length of Stay (LOS) and the number of patients who LWOBS in the Emergency Department at Martin Army Community Hospital (BMACH). Benchmarks established by the Centers for Disease Control are used as a standard to compare performance in

LOS and LWOBS numbers. Non-urgent patients comprise the majority of patients seen in the ED. The high number of non-urgent patients was the primary reason for implementing a Fast Track in the ED. A Fast Track is a process created in the ED for treating low acuity patients that can be evaluated and treated quickly with the goal of reducing cost and length of stay. Recent literature supports implementing a Fast Track process to reduce length of stay in order to compensate for increasing overcrowding in Emergency Departments. The ED Fast Track was established at BMACH in June 2005, but its effectiveness was not evaluated. For the purpose of this study, effectiveness was be measured by LOS, patient satisfaction, and the number of LWOBS.

Currently, the primary care clinics are not producing sufficient appointments to meet the demand generated by the 47,000 enrolled beneficiaries. In response, the BMACH leadership is making improvements in primary care access which, in turn, will lower the patient volume in the ED. However, the initiatives to increase access and productivity in these areas have not been fully implemented. If access in the ED were improved, then beneficiaries could access care through that venue until improvements can be made in the primary care appointment schedules. Even after access is improved in primary care, the ED will likely see higher volumes as approximately

30,000 additional beneficiaries are assigned to BMACH resulting from the changes under the Bipartisan Realignment and Base Closure Commission (BRAC). Therefore, maximizing efficiency and access is vital to dealing with current and future challenges.

Fort Benning and Martin Army Community Hospital

Fort Benning was established in 1918 and is named for Confederate General Henry L. Benning. The base covers approximately 182,000 acres (737 km²). Fort Benning is home to the US Army Infantry Center and is predominantly concerned with training soldiers in infantry and related skills. It is also home to the Infantry Training Brigade, Basic Combat Training Brigade, Airborne School, Infantry Officer Basic and Advanced Courses, the Non-Commissioned Officer Academy, the Ranger Training Brigade, and the Drill Sergeant School. The 3rd Battalion of the 75th Ranger Regiment and the 3rd Brigade of the 3rd Infantry Division are also located at Fort Benning. The 2005 Base Relocation and Closure Commission recommended that Fort Benning transform itself into the Army's Maneuver Center by integrating the Armor School from Fort Knox which will significantly increase the training mission of the post.

Martin Army Community Hospital has a long and significant history in military health care according to its website:

> Martin Army Community Hospital, named in honor of the late Major General Joseph I. Martin, MC, was opened on 8 April 1958, at a cost of slightly over $8 million for the initial construction. The modern nine-story building is a 57-operational bed facility that provides medical care to an eligible patient population in excess of 80,800 beneficiaries. Within the hospital's 9 floors are 5 patient units/wards, an extensive surgical suite with same-day surgery capabilities, a Women's Wellness Center, OB/GYN and a Labor and Delivery suite, and over 30 ambulatory care clinics. In order to provide these extensive medical services, the MEDDAC employs approximately 750 civilians and 680 military staff members. Each day, the hospital provides inpatient care to approximately 46 patients and averages nearly 1,500 outpatient visits. On average, there are 3 babies born every day and the hospital's Outpatient Pharmacy dispenses over 2,000 prescriptions (BMACH Webpage, 2006).

Martin Army Community Hospital (BMACH) is responsible for 76,273 beneficiaries currently and is expected to care for an additional 30,000 beneficiaries in the near future due to force structure changes in the Army.

The mission of BMACH is to promote the health of its soldiers and other beneficiaries. Its vision to provide safe,

quality healthcare in an environment that promotes innovation. Furthermore, the BMACH staff values a patient-centered focus in providing care (see Appendix B). Efforts to improve the ED are in keeping with its mission, vision, and values.

The BMACH Emergency Department staff sees approximately 30,000 patients a year. In 2005,the ED staff saw 29,993 patients. This was a 3% decrease from the previous year. The number of patients seen per day fluctuates between 60 and 115. Non-urgent patients may wait up to five hours to been seen by a provider and length of stay in the ED can last 12 hours or more. The highest utilization occurs on weekends around holidays where the primary care clinics are closed. Long wait times directly contribute to a higher number of patients who left without being seen (Arendt, Sadosty, Weaver, Brent, & Boie, 2003). In response to the long wait times, process action teams are looking at patient throughput and implementation of electronic record systems to improve throughput and patient care in the ED at BMACH.

Conditions that Prompted the Study

The Hospital Commander is concerned with overcrowding in the Martin Army Community Hospital Emergency Department due to the impact on patient care and wait times. The Commander is attempting to improve efficiency in the Medical Treatment Facility and has identified the Emergency Department as one of

the clinical areas of concern due to its high volume. Over the past two years, patient visits to the ED have increased as a result of the lack of available primary care appointments (M. Rivera, personal communication, March 16, 2006). In addition, there is a potential for poor outcomes as a result of delays in evaluation and care caused by long waits. While efforts are being made to increase primary care access, the ED staff must shoulder the burden of a high number of non-acute patients that require care. In addition, the BMACH command group anticipates a significant increase in beneficiaries over the next three years due to the planned expansion of soldiers assigned to this post under the Base Realignment and Base Closure Commission of 2005. The ED staff must improve its efficiency in the near term in order to more appropriately handle the patient load until clinic access improves and more funding becomes available to increase capacity.

Before further initiatives to improve efficiency can be entertained, the current state of affairs must be evaluated. Recently, the Emergency Department staff implemented a Fast Track and questions remain on the effectiveness of this effort. Reducing length of stay of non-urgent patients should reduce the number of LWOBS. A reduction in LOS for urgent patients and an improvement in patient satisfaction are also anticipated as a result of Fast Track implementation.

The majority of patients seen in the ED are non-urgent. In April 2005, two months prior to fast track implementation, approximately 76% of the patients seen in the ED were triaged as non-urgent. This result is similar to the 80% of patients triaged in the ED of Eisenhower Army Medical Center which is one of the Military Treatment Facilities geographically closest to BMACH (Sizemore, 2004).

Access to care is a significant issue in healthcare and has been an identified problem at BMACH. According to Flacone and Hartwig (1991) the academic field of healthcare policy has wrestled with the competing issues of cost, quality, and access. The Emergency Department contends with its own access challenges as well as lack of access in the outpatient care system. The ED can be seen as a bellwether for the healthcare system in terms of lack of access. Overcrowding in emergency departments reflect a lack of primary care services (Shi & Singh, 2004). Emergency department overcrowding at BMACH indicated to the leadership that they have an access problem at Fort Benning that must be addressed beyond the ED.

In addition to access, another aspect of care is timeliness. Timeliness is one of the goals outlined in *Crossing the Quality Chasm* and applies to the situation in the ED (Institute of Medicine, 2001). It is imperative that we see patients in a timely fashion to support the organization's goal of providing

quality care to our beneficiaries. Timeliness can be measured by benchmarking ourselves to other facilities. Failure to achieve timely care puts our patients at risk. Increased wait times often result in a higher number of patients leaving with potentially dangerous conditions not identified and treated (Goodacre & Webster, 2003). The ED staff attempts to contact individuals who leave prior to being seen the following day to be sure they are safe and receive follow-up care. There is significant concern that patients who leave without being seen will not receive necessary care resulting in a preventable bad outcome (Goldman et al., 2005).

Statement of the Problem or Question

There are a number of factors which contribute to the patient wait times, LWOBS, and patient satisfaction in the Emergency Department. The focus of this study was to determine the impact of a Fast Track on Length of Stay, number of patients Left Without Being Seen, and patient satisfaction. The research question this study asked is: Did implementation of an Emergency Department Fast Track improve patient care as measured by length of stay, number of patients left without being seen, and patient satisfaction?

This question is important to improving care in the ED. Wait times significantly affect length of stay and are a common source of patient complaints. Length of stay also reflects

delays in providing care throughout the ED experience as well as staff productivity. The number of patients who leave without being seen are an indicator of patient satisfaction particularly with regard to timely care. The patient population at Fort Benning often visits the ED when appointments are not available which may negatively affect patients' perception of care at BMACH. Patient satisfaction must also be addressed if ED services are to become more patient centered. The satisfaction survey used by the AMEDD addresses patients overall experience.

Answering the research question helps achieves three goals derived from *Crossing the Quality Chasm*: 1) Making care more patient-centered; 2) Improving patient access to care; and 3) Improving the timeliness of care provided (Institute of Medicine, 2001). These three goals are significant for improving health care. Addressing length of stay, LWOBS, and patient satisfaction improved services at BMACH's ED and provided justification for the fast track process.

Literature Review

The term fast track refers to a process which is accelerated. The term was first used in a *Business Week* article which described the changes in the construction industry's practices in order to speed production (Wikipedia, 2006). In the field of Emergency Medicine, a Fast Track is a separate system of care created in an Emergency Department to expedite

patient care. It often focuses on patients whose condition can be diagnosed and treated quickly. Fast Tracks have their own providers, support staff, and separate facilities (Hampers, Cha, Gutglass, Binns, and Krug, 1999). Some hospital systems provide Fast Tracks with their own ancillary services such as laboratory and radiology. Fast Track systems were created to reduce patient waiting times and improve patient throughput. Often times this was done in response to Emergency Department overcrowding.

Emergency Department crowding has been identified as a growing problem (Patel & Vinston, 2005). Emergency departments must contend with high acuity, hospital bed shortages, inadequate space, and resources (Patel & Vinston, 2005). From 1993 to 2003 the number of ED visits increased 26 percent (CDC, 2005). Asplin, Magid, and Rhodes (2003) report that EDs are under increasing pressure to see more patients which has resulted in overcrowding. Overcrowding in the ED may result in poor patient outcomes, in addition to reduced patient satisfaction, longer wait times, and higher numbers of patients who left without being seen (Patel & Vinston, 2005).

The problem of longer wait times and throughput are not unique to emergency rooms or healthcare in general. Queuing theory is the mathematical study of waiting lines first proposed by Agner Krarup Erlang in 1909 (Wikipedia, 2006). It studies

wait times and involves a population waiting to be moved through a servicing system. The term "queue" refers to the waiting line. Queuing Theory is often used for analysis and modeling of processes that involve waiting (McManus, Long, Cooper, & Litvak, 2004). This theory was first utilized to describe waiting times in telephone networks but has successfully been applied to patients waiting to be seen by healthcare providers. Queuing Theory has been successfully used to analyze hospital activities to include emergency departments (McManus et al., 2004). A simple diagram can be constructed to describe the process of waiting in the ED at BMACH (see Appendix H).

Yoon, Steiner, and Gilles (2003) suggest that the average waiting times in a single-server queuing system can be minimized by first serving customers with the shortest expected service time. This is referred to as the "shortest processing time" queuing strategy (Yoon et al., 2003). In the ED, the opposite occurs where the most acute patients with the longest service time are seen first based on the principle of preserving life and limb. Implementing a Fast Track process enables adopting a shortest processing time strategy without abandoning the ethic obligation to treat the most acutely ill immediately based on current Emergency Department triage.

There is a significant amount of literature supporting Fast Track processes in the Emergency Department. The use of a separate stream of care for minor injuries is believed to reduce waiting times for less urgent patients (Cooke, Wilson, & Pearson, 2002). Meislin, Coats, Cyr, and Valenzuela (1988) showed that a Fast Track can significantly reduce mean length of stay for non-acute patients. The Institute for Healthcare Improvement (2005) recommends establishing fast-track process for urgent conditions that can be treated quickly as a method to reduce patient waiting time. Another study on pediatric patients found that mean length of stay was reduced by implementing a fast-track as well as reducing the number of diagnostic tests ordered (Hampers, et al., 1999). The research supports the case for creating a fast-track process in the Emergency Department to reduce length of stay.

A Fast Track may influence patient satisfaction by reducing wait times. The amount of time a patient spends in the ED is a function of triage level, patient diagnosis, and congestion at the time of patient arrival (Cerrito & Pecoraro, 2005). Meislin, et al. (1988) attributed a reduction in patient complaints by 57% to the reduced waiting times in a Fast Track. Fast Tracks are often staffed with physician assistants or nurse practitioners. Counselman, Graffeo, and Hill (2000) found that staffing a Fast Track with physician assistants did not

negatively affect patient satisfaction. In addition, Wright, Erwin, Blanton, & Covington (1992) determined that using nurse practitioners in a Fast Track did not result in lower patient satisfaction scores either. It appears that using physician extenders in a Fast Track does not hurt patient perceptions of quality care and patient satisfaction may increase due to reduced waiting times.

A number of studies have been conducted on patients leaving without being seen (LWOBS). Goodacre and Webster (2005) determined that patients who LWOBS increased during periods of prolonged wait times. In pediatric emergency departments, patients who LWOBS tend to have lower acuity levels (Goldman, Macpherson, Schuh, Mulligan, and Pirie, 2005) and primarily leave due to wait times being too long (Goldman, et al., 2005). Weiss, et al. (2005) determined that the number of patients who LWOBS correlates with ED overcrowding. Thus, a vicious cycle can develop when overcrowding leads to increased wait times which then leads to increased numbers of LWOBS that results in decreased patient satisfaction.

Previous studies in the ED have used a variety of statistical methods to conduct comparisons of the population means from pre and post-implementation of a new process or procedure in the ED. Rylander (1999) examined patient wait times in the ED for emergent, urgent, and non-urgent patients

before and after improvements were made at Winn Army Community Hospital using analysis of variance. Paulson (2004) analyzed trends in LWOBS and compared wait times using two-tailed t-tests. Huag, Chen, Yang, and Lee (2004) conducted a several *t*-tests and Chi-squared tests to evaluate effectiveness of implementing a balanced scorecard in an ED. Hampers, et al. (1999) showed a statistically significant difference in patient wait times related to implementing a Fast Track in the ED. Thus, statistical tests used to evaluate emergency department changes include the two-sample *t*-test, Chi-squared test, and analysis of variance.

In order to improve performance in the Emergency Department as measured by length of stay, and LWOBS, standards and metrics must be developed. A simple comparison of before and after measures does not address how the ED staff should be performing, rather it just determines performance improvement. Karpiel (2000) recommends comparing data to national benchmarking data developed by associations and consulting groups. Griffith and White (2002) define a benchmark as a quantitative measure of best known performance. Benchmarks must be clearly defined, valid, reliable, and adjusted to the particular institution by factoring out differences (Griffith & White, 2002).

The Voluntary Hospitals of America (VHA) network determined benchmarks to measure performance in Emergency care in 1998.

These benchmarks included arrival to discharge/transfer time, staffing costs per patient visit, patients per physician hour, lab and x-ray order times, and patient and family satisfaction (Craig, 1999). Length of stay is comparable to arrival to discharge time. Lab and X-ray times are beyond the scope of this study but may be considered in the future. Patients per physician hour averaged 1.8 over the past year in the ED at BMACH which is less than the benchmark of 2.13 used by the VHA. The implementation of the Fast Track actually reduced the patient per physician (provider) hour average at BMACH due to a loss of patients seen in the main ED.

There are many averages, standards, and benchmarks established by different organizations that can be used to measure performance in emergency medicine. For the purposes of this study, benchmarks were based on the National Hospital Ambulatory Medical Care Survey: 2003 Emergency Department Summary conducted by the National Center of Health Statistics of the Centers for Disease Control and Prevention. This survey was chosen due to the large amount of data it collected. The survey captured data from 113.9 million ED visits. The survey reports statistics on selected hospital, patient, and visit characteristics of emergency care. Benchmarks used in this study were determined based on theses statistics. The benchmark for patients who LWOBS was established by combining the

statistics for patients who leave Against Medical Advice (AMA) as well as those who left before being seen. In the survey, the patients who left before being seen accounted for 1.7% of ED visits and correspond directly to the definition of LWOBS. Patients who leave AMA accounted for 1% of patients in the survey, but our numbers at BMACH are much lower at approximately 0.2% which, for the purpose of this study, is assumed to be at the expense of our LWOBS percentage. The "patients who LWOBS" benchmark of 2.7% was an adjusted average based on the CDC survey attempting to better evaluate the ED performance at BMACH. Average Length of Stay was left unchanged from the CDC survey at 3.2 hours (192 minutes) described as total time in ED.

The literature reports different averages for the percentage of patients who LWOBS. The lowest reported figure was 1.7% (CDC, 2005) while the highest was 15% (Weiss, 2005). In the local area of Columbus, Columbus Regional Medical Center estimated its patients who LWOBS to be 5% (T. Boyd, personal communication, January 9, 2006) while St. Francis Hospital reported it as being less than 2% since 2000 (C. Homeyer, personal communication, January 18, 2006). The average at BMACH was 4.3% from August 2004 to January 2006.

Length of stay also varies in the literature but not as much as LWOBS. Arrival to discharge time averaged approximately 225 minutes for the VHA study (Craig, 1999), while the CDC

reported an average of 192 minutes (CDC, 2005). Karpiel (2000), found his hospital had a length of stay of 171 minutes.

Differences were also noted in length of stay based on patient acuity. Emergency departments conduct triage based on level of immediacy which is assigned upon arrival at the ED (CDC, 2005). The Emergency Department at BAMCH uses a five category system (see Appendix C). Patients who need to be seen immediately are classified as emergent, patients who need to be seen within an hour are classified urgent, and patients whose care can be delayed are classified non-urgent. For urgent patients, length of stay was reported to be 161 minutes (Meislin, 1987) and 178 minutes (Karpiel, 2000) in the literature. Likewise, non-urgent patient length of stay was reported to be 94.5 minutes (Meislin, 1987) and 138 minutes (Karpiel, 2000).

Another method to measure performance of the ED at BMACH is to base goals on the Military Health System of which BMACH is a part. The Military Health System uses a Balanced Scorecard to describe, implement, and measure its goals. The Balanced Scorecard (BSC) is an organizational framework for managing strategy developed by Drs. Robert Kaplan and David Norton (Pere, 2004). It involves evaluating an organization based on four perspectives which consists of the customer(s), internal business processes, organization learning and growth, and

financial processes (Pere, 2004). The BSC process involves developing metrics, collecting data, and conducting analysis for each perspective. Implemented properly, the BSC impacts all levels of an organization (Pere, 2004).

Within the BSC process a "strategy map" is developed to outline goals under the four perspectives. The current MHS Balanced Scorecard Strategy Map (see Appendix G) includes the goal of improving customer service and increasing patient centered focus and patient safety under the customer perspective and the internal business process perspective (U.S. Department of Defense Military Health System, 2006). These goals can be aligned with the ED priorities of reducing patient LOS and LWOBS. Length of stay can be tied to improving customer service. The emphasis placed by the Command fits under the goal of increasing patient centered focus as this metric considers the need for patients to have timely access to the ED. The number of patients who left without being seen is also a patient safety issue as these patients may need immediate treatment and must be followed up by the ED staff and the patient safety officer. Other goals established by the MHS Strategy Map that can be applied to the ED include: optimizing stewardship of resources and increasing productivity (U.S. Department of Defense Military Health System, 2006). These goals are not

under consideration in this study, but can be evaluated at a later date.

British researchers Goodacre and Webster (2003) determined that older patients and those with lower triage priority had longer wait times. The most powerful predictor of wait times is time of presentation with longer waits associated with night times. The fall season also was associated with longer wait times. Patients who left without being seen were more likely to be younger, male, low acuity, self-referred. They found that the following characteristics are predictive of wait time: age, triage category, mode of arrival, time of presentation, day of week, and month. One of the limitations of the study is that it was conducted on an adult population in the British healthcare system. Pediatrics cases were not part of the study population and all patients were insured by the government.

Goodacre and Webster (2003) also determined the following characteristics as predictive of LWOBS: age, sex, triage category, time of presentation, mode of arrival, day of the week, and month. The prevalence of patients who LWOBS in this study is 7.2% and men were found to be more likely to leave without being seen than women.

They advocate improving equity of wait times given that some patients will wait longer than others due to certain characteristics (Goodacre & Webster, 2003). Improving access

would require more staff at certain hours, such as the nighttime to make ED services more equitable between daytime and nighttime patients. However, this may result in higher costs due to increased pay given to nighttime staff. Crude measures of waiting time, such as the number of patients seen within an hour may promote efficiency at the expense of equity (Goodacre & Webster, 2003).

Currently, Fast Track systems exist in two of the community hospitals. Both Columbus Regional Medical Center and St. Francis Hospital have successfully implemented Fast Track processes in their EDs. The Fast Track system at St. Francis uses one to two providers and cares for up to seven patients at a time with the goal of seeing and discharging patients within two hours (C. Homeyer, personal communication, January 18, 2006). In addition, both Columbus Regional and St. Francis hospitals have Urgent Care clinics that see patients with low acuity problems who need to be seen. These patients are not urgent by the Emergency Department Triage standards but are unable or unwilling to wait for primary care appointments. Both hospitals have created multiple channels for care in order to decompress their ED and to reduce costs and waiting times.

Process Improvement Efforts in the ED

In September 2005, the author was asked to look at patient throughput in the ED to address the trend of increased length of

stay in the ED up to and occasionally exceeding 12 hours. Patients were complaining of long wait times and delays in care. The issue was investigated over a two-week period with the Nurse Method Analyst, LTC Paul Hird, and a presentation on patient throughput was made to the Hospital Executive Committee and the ED leadership in October 2005. The throughput project compared length of stay and wait times to benchmarks and showed variations in provider productivity. Linear regression was used to determine that the number of patients who left without being seen, in part, depended on our patient volumes. The project also showed how the primary care and Troop Medical clinics overflow into the ED.

The project determined that implementing the Fast Track process reduced length of stay, supported the triage process, noted a disparity in provider productivity, and identified delays in transferring patients to other facilities. The Fast Track process was validated based on a pilot study of 70 non-urgent patients. The pilot study showed a mean reduction of 67 minutes between the pre-Fast Track (M=179.21, SD=153.97) and Post-Fast track (M=111.61, SD=60.16) groups $t(138)=3.42$, p=0.00 (one-tailed). The throughput project supported the current practice of using RNs to conduct triage based on current literature and identified two other contributing factors to long ED wait times. First, the difficulty in finding beds in other

facilities as well as finding an accepting physician in patient transfers, and second a disparity in the number of patients seen per provider per hour was noted among the ED providers.

Several recommendations were made for the Emergency Department to reduce length of stay and waiting times. The recommendation was made to continue the Fast Track and to consider supplementing its staff with Family Practice Residents as needed. The project also recommended adding a clerk to the nurses' station to help with administrative functions to include patient transfers. Imposing a limit on the number of hours a patient could be held in the ED while awaiting transfer or admission was strongly suggested based on the patient safety and satisfaction. The project also recommended that patients should not be referred from the hospital's clinics to the ED for admission but should be admitted directly by the provider in the clinic (assuming the provider has admitting privileges).

The recommendations to limit length of stay and clinic admission through the ED were adopted. However, the recommendations to have Family Practice residents support the Fast Track and the hiring of additional clerks was not adopted at that time. Lengths of stay longer than six hours are reported and tracked by the hospital command. The Fast Track was continued. The ED continues to track provider productivity based on number of patients seen per hour.

LWOBS as a Function of Volume

One of the more interesting issues identified by the Patient Throughput Project was the relationship between patients seen and number of patients who left without being seen (LWOBS). The project confirmed that the number of patients who left without being seen is a function of patient volume in the Emergency Department. Weiss (2005) determined that the number of patients who LWOBS correlated well with overcrowding. Overcrowding in the study was determined using the National Emergency Department Overcrowding Scale. No measure of overcrowding has been established in the ED at BMACH. However, the author examined this issue in October of 2005 by correlating the number of patients seen to the number of patients who LWOBS. The results of this correlation confirmed the theory that overcrowding at BMACH occurs when more than 90 patients are seen within a 24 hour period. This was determined by comparing the percentage of patients who LWOBS to a benchmark of 2.7%. At 90 patients, the ED staff will see an average LWOBS rate of 4% which clearly exceeds the benchmark. The correlation between patient volume and the number of patients who LWOBS was determined to be 0.55. This compares favorably to the correlation of 0.68 determined by Hobbs (2000). A graph was created to illustrate the relationship and was briefed to the ED

leadership and the hospital command in November 2005 (see Appendix I).

Hobbs, Kunzman, Tandberg, & Sklar (2000) determined that the most powerful predictor for patients who LWOBS was patient volume. Other significant predictors identified in the literature include the number of trauma patients, resuscitation attempts, and observation unit admissions (Hobbs et al., 2000). The hospital staff does not routinely see trauma patients and performs very few resuscitation attempts. Martin Army Community Hospital also does not currently have an observation unit but the number of admissions and patient transfers may impact LWOBS.

Healthcare Failure Mode and Effects Analysis: Patient Flow

A Healthcare Failure Mode and Effects Analysis (HFMEA) is a process that attempts to identify and prevent process and product problems (T. Garnett, personal communication, January 15, 2006). A HFMEA was conducted by the Risk Management Officer at BMACH on the ED. This was done to identify potential risks associated with problems in patient throughput resulting in delays in care and potential risks as the result of the inability of the ED to monitor critical patients long term. The HFMEA committee identified delays caused by required CHCS data entry, transfer issues, admission issues, and concerns over the current structure of the ED. The process concluded in February 2006 and the committee recommended several changes to reduce

patient risk. Recommendations included: adding a clerk to the nurses station to help in administrative responsibilities, increasing the attending physician's role in admissions, imposing an upper limit of length of stay, and remodeling the ED.

Informatics Process Action Team

Another issue investigated in the ED involved whether the hospital should implement an electronic record system in the ED beyond the CHCS I which is currently being used. A Process Action Team was created by Information Management to investigate this issue. The PAT determined that there is value in implementing a electronic record system such as Clinical Information Systems which is currently in use in the inpatient area. Electronic medical records enable managers to conduct analysis and be proactive based on the acquisition of critical data (Cerrito & Pecoraro, 2005).

The advantage of implementing such a system is that the electronic records created for care will be easily available to providers outside of the ED. Also, it will be possible to create reports on ED performance by querying the electronic database. This will significantly reduce the time it takes to compile information on the ED and will avoid missing data. Systems are in place to audit CIS for completeness and compliance. It is anticipated that electronic records will

increase situational awareness and oversight in terms of workload. Both US Naval Hospitals in Okinawa, Japan and Jacksonville, Florida report that using a web-based patient tracking database improved throughput, situational awareness, and reduced risk (Schmidt, 2006). Clinical Information Systems has a similar capability to track patients much like the system used by the Navy.

Kerkenbush and Cuda (2006) found that replacing the traditional whiteboard used to track patients in the ED at Womack Army Medical Center with a plasma screen that uses a database application that interfaces with CHCS, improved staff communication. The authors speculate that it will improve length of stay in the ED particularly for patients awaiting admission by increasing provider awareness. The Information Management PAT recommended that the ED replace its whiteboard with a computer database transmitted on a plasma screen.

Purpose

The purpose of this study was to determine the effects of implementing a Fast Track in the Emergency Department. Establishing the effectiveness of the Fast Track is important to justifying the resources dedicated to this product line and must be conducted prior to making any additional changes to improve throughput. This study determined the effectiveness of the Fast Track as measured by length of stay, number of patients left

without being seen, and patient satisfaction. The findings were applicable to other Military Treatment Facilities and smaller civilian hospitals.

Variables

Variables used in this study include one independent variable (Fast Track Implementation) and three dependent variables (LOS, LWOBS, and overall patient satisfaction). The Fast Track was implemented at BMACH in June 2005. Data were collected for the six months prior to and after June 2005.

The independent variable in this study was implementation of the Fast Track process in the Emergency Department, coded as a dichotomous variable. The study used three dependent variables. Length of stay was defined as the time from check-in to disposition. The check-in time and disposition times were recorded on the SF 558 form used in the ED at BMACH, recorded in minutes.

The dependent variable length of stay was examined for non-urgent patients and urgent patients. Non-urgent patients were defined as Category 4 and 5 in the triage system used as BMACH. Urgent patients were defined as Category 2 and 3. Category I (Emergent) patients are seen immediately and only account for a small number of patients seen at BMACH. The Fast Track staff only sees non-urgent patients. However, the Fast Track process may impact the length of stay for ED patients not seen in the

Fast Track. Emergent patients are not included in the study as they do not wait for care.

The dependent variable left without being seen was defined as a patient that leaves the ED after checking in, but before being seen by a provider. These data were reported on the evening/night nursing supervisor report which is reported each day and is found on the Intranet at BMACH. The data reflected the number of LWOBS each day during the study period and are ratio data.

Patient satisfaction was defined as the overall satisfaction score for the Emergency Department at BMACH on the AMEDD Provider Level Patient Satisfaction Survey. This survey is implemented and tracked by the Army Medical Department for all Medical Treatment Facilities. It is coded on a Likert scale of one to five (see Appendix F) and reported as a percentage of respondents that answered somewhat satisfied or completely satisfied to the question on overall satisfaction. The data collected are nominal data reflecting the Likert scores reported on the patient satisfaction surveys collected for the six month before and after the Fast Track was implemented.

Methods and Procedures

This study compared the length of stay for patients in the Emergency Department, the number of patients left without being seen, and patient satisfaction before and after implementation

of the Fast Track. To compare length of stay (LOS), patients were divided into two groups, non-urgent patients seen in the ED prior to implementation of the Fast Track and non-urgent patients seen in the Fast Track. The data were analyzed using descriptive statistics and two-sample *t*-test for independent groups. Significance level is set at 0.05. The data were analyzed using Microsoft Office Excel 2003. The test was used to determine if there was a statistically significant difference between the two groups. The null hypothesis is: there is no statistically significant difference between the two groups; therefore the Fast Track has no significant effect on LOS.

The LOS for urgent patients was also examined by dividing patients into two groups, urgent patients seen before implementation of the Fast Track and urgent patients seen after implementation of the Fast Track. The goal is to determine if implementation of the Fast Track affected LOS on urgent patients. Urgent patients are not seen in the Fast Track, but creating the Fast Track may make treatment of all patients in the ED more efficient as measured by LOS. The data were tested identically to the non-urgent group, using a t-test. The null hypothesis is: there is no statistically significant difference exists between the two groups, indicating the Fast Track has no significant effect on LOS of urgent patients.

The number of patients left without being seen (LWOBS) were compared prior to and after implementing the Fast Track. Two groups will be created, LWOBS prior to the Fast Track and LWOBS after implementing the Fast Track. The data were tested using descriptive statistics and t-test used identically to the LOS analysis. The null hypothesis is: there is no difference in the number of LWOBS before and after implementation of the Fast Track.

Finally, this study reviewed the hospital's patient satisfaction scores from the AMEDD Provider Level Patient Satisfaction Survey. The results of this survey are currently posted on The Office of the Surgeon General Web page. The survey reports patient satisfaction results by provider, by department/clinic, and by MTF. The Survey results for Fort Benning's Emergency Department for the six months prior to the implementation of the Fast Track were compared to survey results of the six months after the implementation. The Department of the Army received 886 surveys from 6 December 2004 to 22 May 2005. However, only 439 surveys were received from 01 July to 31 December 2005. The scores are from a five point Likert scale (See Appendix F). The results were provided by The Office of the Surgeon General, Survey Program Office as a Excel file listing individual survey results. No patient information was included nor was required for this study. The data were tested using

descriptive statistics and t-test. A random sample of 439 surveys from the 886 received from December 2004 to May 2005 was compared to all 439 surveys received from July 2005 to December 2005. The null hypothesis is: there is no difference in the overall patient satisfaction score before and after implementation of the Fast Track.

Sampling

The population in this study consists of patients seen at the Emergency Department of Martin Army Community Hospital. It is not possible to account for seasonal effects given the limited time to collect data post-implementation. Approximately 30,000 patients are seen in the ED each year.

Sample size for length of stay testing was determined by the formula derived by Isaac & Michael (1995) (see Appendix A). Isaac & Michael (1995) created this formula to determine a reliable sample size within a set amount of error that can be tolerated (in this case 5% from the population). Using this formula, the sample size is 379. A total of 384 records were reviewed for length of stay prior to and after implementation of the Fast Track. This was done for urgent and non-urgent patients. The 384 records selected for both urgent and non-urgent patients were selected at random. Random sampling is a proven reliable method of obtaining a representative sample (Polit, Beck, & Hungler, 2001). A sampling frame was developed

based on data collected from the SF 558 Patient Treatments forms for all patients seen in the ED. Incomplete data was omitted. The months of December 2004, January 2005, and February 2005 were missing from the database complied by the ED administrative staff. In order include data from these months, 64 records from each month were randomly pulled from the original files and the data was manually added to the database. To establish equal weight for each month of the year, 64 records were randomly selected for each month to equal 384 records. This number allowed a representative sample for each month and exceeded the required number of 379 established as a reliable sample for a population of 30,000. Ideally, a sampling frame would be established from all SF 558s for the time period under investigation. Simple random sampling is a laborious process (Polit, Beck, & Hungler, 2001) and in the interest of time a representative sample need to be selected for the missing months of data rather than manually creating a database for the several thousand patients seen from December 2004 to February 2005. Cluster sampling, as used in this situation, tends to contain more sampling error (Polit, Beck, & Hungler, 2001) but was practical in this case.

The number of patients left without being seen was reviewed on a daily basis for the six months before the fast track was implemented and for the six months after. The sample size

included 180 days worth of data for both pre-implementation and post-implementation. Due to the limited time under investigation, a larger sample was not possible. The data included all reported LWOBS for the period starting in December 2004 and ending in December 2005.

For the patient satisfaction survey, the sample size was limited by the number of respondents that answered the survey and the requirement to have equal sample sizes. Partial answers were included if they addressed the questions on total satisfaction. The response rate was 4% of the population. Polit, Beck, & Hungler (2001) suggest that research studies should address response rates and nonresponse bias. Nonresponse bias is defined by Polit, Beck, & Hungler as the difference between the participants and those who do not participate. No area of bias was identified by OTSG for the satisfaction survey. The survey respondents were fairly evenly distributed between male and female and appeared normally distributed by age. The response rate captured a large enough sample size to achieve statistical power.

Incomplete data were omitted from the study. This had no impact on the LOS studies due to the large number of complete records to establish a random sample of 384. However, the data collected for LWOBS were affected by missing reports which

reduced the desired sample size of 180 days worth of data to 158.

Descriptive statistics are used to describe and summarize data (Polit, 1996). This study will look at the differences in the means between groups. The expectation is that the means for LOS, LWOBS, and patient satisfaction will be lower for the post-Fast Track implementation groups than the re-implementation groups.

A two-sample t-test is used to draw inferences about the means of populations (Polit, 1996). The difference of two means is being tested. This statistical test relies on several assumptions about the subjects. The subjects of the test must be randomly sampled, normally distributed, and variances of the two populations are equal. The *t*-test is robust in regard to normality, therefore results are considered accurate even when the assumption is not satisfied when dealing with a reasonably large sample size (Polit, 1996). Polit (1996) further asserts that the assumption of homogeneity of variance can also be ignored when the sample sizes are large. Large and equal sample sizes were used in this study. The population of the Emergency Department is 30,000 which is the approximate annual number of patients seen per year in 2003 and 2004.

In determining the results, it is important to consider whether the results are statistically and clinically

significant. In a clinical application, both statistical significance and clinical significance must be considered (Neely, et al., 2003). Achieving statistical significance in this study rests on allowing less than 5% error (alpha set at 0.05). If this is the only concern then fewer subjects are needed to minimize type I error, also known as false-positive error (Neely, et al., 2003).

In order to reduce Type II error, a larger population is needed. Beta, or Type II error, defines when a false-negative error has occurred. This means the hypothesis has been accepted when in reality difference exists. Beta is usually set at 0.20 in clinical research (Neely, et al., 2004). The power refers to the ability to detect a difference and is defined at 1-beta. Therefore, at 0.20, power is 80 (Neely, et al., 2004).

When determining the P value associated with the *t*-test, degrees of freedom are considered. The degrees of freedom are defined as the number of variations in observations. In contingency tables of the independent groups *t*-test, the formula for degrees of freedom is:

$$df = n_1 + n_2 - 2$$

The degree of freedom is essential to determine the P value from the table of probabilities (Polit, 1996).

The primary issue under investigation is whether there is a difference in the mean scores of patient length of stay and

number of patient left without being seen. Implementing a Fast Track in a Emergency Department should result in a decrease in LOS and patients who LWOBS. The issue relies on the statistical significance of the results. The observed results must be inconsistent with the null hypothesis to allow less than 5% (alpha=0.05) probability of error. If the study results are not statistically significant, but the difference is perceived to be clinically important, type II error may be present (Neely, Gail, Hartman, Forsen, & Wallace, 2003). The sample size of the length of stay and patient satisfaction samples are sufficiently large enough to allow a power of 0.80 which will minimize risk of type II error using 0.20 as an acceptable criterion for effect size (Polit, 1996). The sample size of patients who LWOBS will only achieve a power of 0.80 if the effect size is at least 0.30.

In addition to minimizing type I and type II error, it is important to determine the strength of the relationship between the independent and dependent variables if such a relationship is determined. To determine the magnitude of the relationship between a dichotomous independent variable and a dependent variable a point biseral correlation coefficient can be used. (Polit, 2006). The point biserial correlation coefficient, r_{pb}, ranges from -1.00 to 1.00 and indicates the strength of the relationship. The formula for r_{pb} is:

$$r_{pb} = \sqrt{t^2 / t^2 + df}$$

The larger the coefficient, the stronger the magnitude of the relationship.

The data were collected using the SF 558, which is a single sheet used to document care provided in the Emergency Department. For the purpose of this study, the SF 558 is relevant as it lists the check-in time, time seen by the triage nurse, time seen by the doctor, triage category, and disposition time. Data from the SF 558 must be captured manually by reviewing each document because the information contained on the SF 558 is not currently being entered into a automated system.

Patients left without being seen are documented on the evening nurse supervisor report. The evening nurse supervisor report captures the number of patients seen in the ED over a 24-hour period and lists the number of LWOBS. The reports are maintained as word documents and kept on the hospital's Intranet files.

The reliability and validity of this study are strictly based on integrity of the information of SF 558s and the nursing report. The patient satisfaction survey has its own testing process to ensure that data is collected and coded accurately. Internal validity is maintained by using the same data sets which prevents differences in the methods of measure. Threats

to external validity in this study are controlled by using a large sample size relative to the population.

Results

Descriptive statistics are arrayed in Table 1. Inferential statistics are displayed in Table 2. This study shows a mean reduction of 48 minutes in length of stay for non-urgent patients $t(384)=8.62$, $p=0.00$ (one-tailed). This was determined by the comparison of non-urgent patients seen in the ED during the six months prior to implementation of the Fast Track ($M=154.08$, $SD=93.35$) compared to the non-urgent patients seen in the Fast Track ($M=1106.90$, $SD=52.78$) in the six months after it was established. This indicates that the implementation of the Fast Track accomplished its original goal of reducing the length of stay of non-urgent patients under the perception of improving patient throughput. The mean of the length of stay for urgent patients was reduced by 42 minutes for urgent patients $t(384)=5.32$ $p=0.00$ (one-tailed). Although urgent patients are not seen in the Fast Track system, they appear to have benefited from the process (Pre-Fast Track $M=218.39$, $SD=153.97$ versus Post-Fast Track $M=176.20$, $SD=102.91$). The number of LWOBS was reduced by an average of 1.04 patients per day $t(157)=3.42$, $p=0.00$ (one-tailed).

Using a calculation tool available on the internet, statistical power was determined to be 1.00 for the non-urgent

patient test, 1.00 for the urgent patient test, and 0.96 for the LWOBS test (UCLA Department of Statistics, 2005). Point biserial correlations for each test were 0.33 for non-urgent patients, 0.44 for the urgent patients, and 0.48 for the LWOBS perspectively. The tests used in this study have met the standard for power and all show a moderately positive relationship between the Fast-Track and reduction of length of stay and number of patients left without being seen.

The Patient Satisfaction Survey results showed a slight increase in patients overall satisfaction with their Emergency Department visit. Patients reported being somewhat satisfied or completely satisfied 87% of the time during the six months (July 2005 to December 2005) after the Fast Track was implemented. During the six months (December 2004 to May 2005) prior to implementation of the Fast Track patients reported being satisfied or completely satisfied 81% of the time. The patient satisfaction survey results were reported in a Likert scale (Pre-Fast Track M=4.24, SD=1.29 versus Post-Fast Track M=4.43, SD=1.08) and the difference was statistically significant $t(439)=-2.30$, $p=0.01$ (one-tailed) while showing a weak positive relationship ($r_{pb}=0.01$).

Compared to the benchmarks determined using the CDC survey data, the Emergency Department staff achieved a reduction in the number of LWOBS/AMA from an average of 4.32% to 2.6% which on

average came under the benchmark of 2.7% (see Appendix J). The length of stay in the ED was consistently below the CDC benchmark of 192 minutes (see Appendix K). The results achieved in the ED after the implementation of the Fast Track process exceeded the standards applied using benchmarking.

Conclusion

Martin Army Community Hospital achieved the goals of reducing length of stay in the Emergency Department for non-urgent patients and reducing the number of patient who left without being seen. This reduction was seen after implementation of the Fast Track. These results are consistent with the literature on Fast Track processes in the ED. Urgent patients had their length of stay reduced event though they were not seen by the Fast Track. Separating urgent and non-urgent patients into different channels appears to have reduced length of stay waiting for both groups. A slight increase in patient satisfaction is seen after implementation of the Fast Track.

This study supports implementation of a Fast Track process in the ED of a military treatment facility. Many civilian Emergency Departments have been using Fast Track systems to reduce overcrowding. Military treatment facilities should consider implementing Fast Track processes to improve efficiency through reducing length of stay.

Recently, the Hospital Commander approved a plan to create a virtual Acute Care Clinic within the current Emergency Department. This clinic will replace the current Fast Track and will see non-urgent patients. The clinic will fulfill the role of the Fast Track, but on a larger scale as it will have more providers, support staff, and will have more rooms. In addition to assuming the role of the Fast Track, the clinic is expected to increase access to primary care services by absorbing some of the patients unable to obtain care in the existing clinics. It is anticipated that the Urgent Care Clinic will lower length of stay and reduce the number of LWOBS beyond what the Fast Track achieved. A Fast Track process could be maintained in the ED to handle non-urgent patients not seen by the Urgent Care Clinic. Many hospitals to include Columbus Regional Medical Center and St. Francis have Fast Track processes in addition to Urgent Care Clinics. This may be an issue at a further date.

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Appendix A

Formula for Sample Size (Isaac & Michael, 1995):

$S = \chi^2 NP(1-P)/d^2 (N-1) + \chi^2 P(1-P)$.

$\chi^2 = 3.84$

N = 30,000

P = .5

d = .05

Appendix B

I. Mission Statement

The Fort Benning Medical Activity mission is to promote and ensure healthy and ready soldiers, and provide quality beneficiary health care in partnership with our communities.

II. Vision Statement

Quality, safe and appropriate health care in an environment that encourages accountable innovation and inspires personal pride and respect for all.

III. Values Statement

Absolute Patient Focus - we will be committed to providing exemplary health services to all entrusted to our care.

Appendix C

Table 1

Triage Categories

Category	*Definition*
I	Emergent - Requires immediate medical attention to prevent loss of life, limb, or eyesight
II	Urgent Priority - Requires priority care to prevent further progression of life threatening medical conditions
III	Urgent Routine- Requires treatment for stable but serious conditions
IV	Non-Urgent Priority - Requires treatment for stable medical conditions where care may be delayed
V	Non-Urgent Routine - Requires treatment for conditions where care may be significantly delayed

Note. Triage System used at BMACH Emergency Department

Appendix D

Table 2

Descriptive Statistics (Means, SDS)

	Pre-Fast Track		Post Fast Track	
Variables	M	SD	M	SD
Non-Urgent Length of Stay (n=384)	154.08	93.35	106.90	52.78
Urgent Length of Stay (n=384)	218.40	116.39	176.20	102.91
Left Without Being Seen (n=157)	3.38	3.58	2.24	2.51
Patient Satisfaction (n= 439)	4.24	1.29	4.43	1.08

Note. Length of Stay is in minutes, Left Without Being Seen is patients/day, Patient Satisfaction is scored 1-5 on a Likert Scale.

Appendix E

Table 3

Inferential Statistics (*t*-test results)

Variables	*t*	*p*
Non-Urgent Length of Stay (n=384)	8.62	<0.00
Urgent Length of Stay (n=384)	5.32	<0.00
Left Without Being Seen (n=157)	11.94	<0.00
Patient Satisfaction (n=438)	-2.30	<0.02

Appendix F

Table 4

Likert Scale from Satisfaction Survey
Response to Question "Overall, how satisfied do you feel about your visit with (your provider)?"

Score	*Definition*
1	Completely Dissatisfied
2	Somewhat Dissatisfied
3	Neither Satisfied Nor Dissatisfied
4	Somewhat Satisfied
5	Completely Satisfied

Source. AMEDD Provider-Level Patient Satisfaction Survey

Appendix G

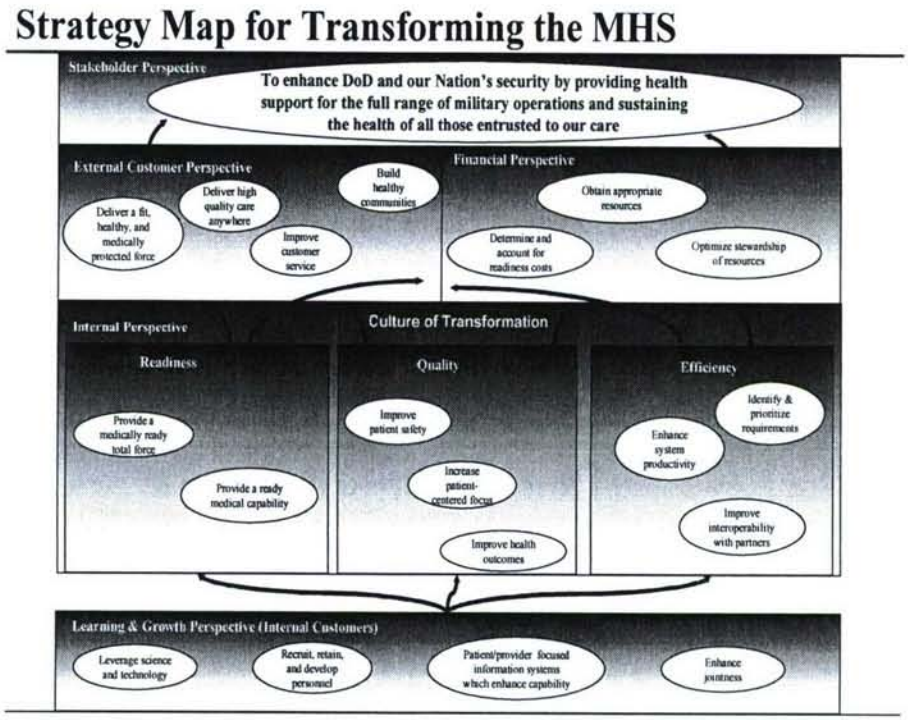

Figure 1. MHS Strategy Map (From "MHS Strategic Balanced Scorecard Overview," by A. Baird and C. Priest, 2005).

Appendix H

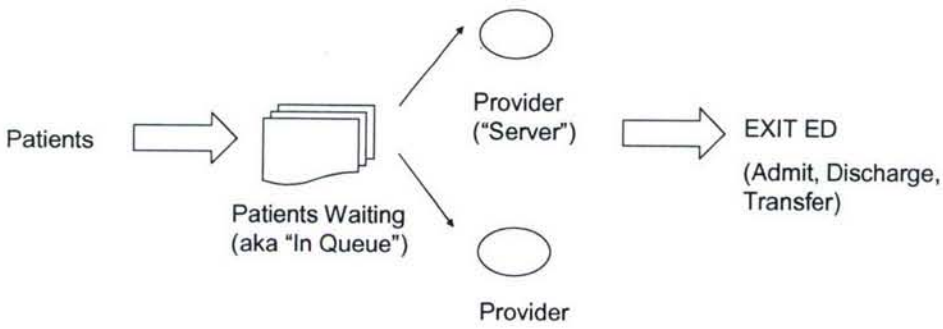

Figure 2. Diagram of Queuing Theory as Applied to the ED.

Appendix I

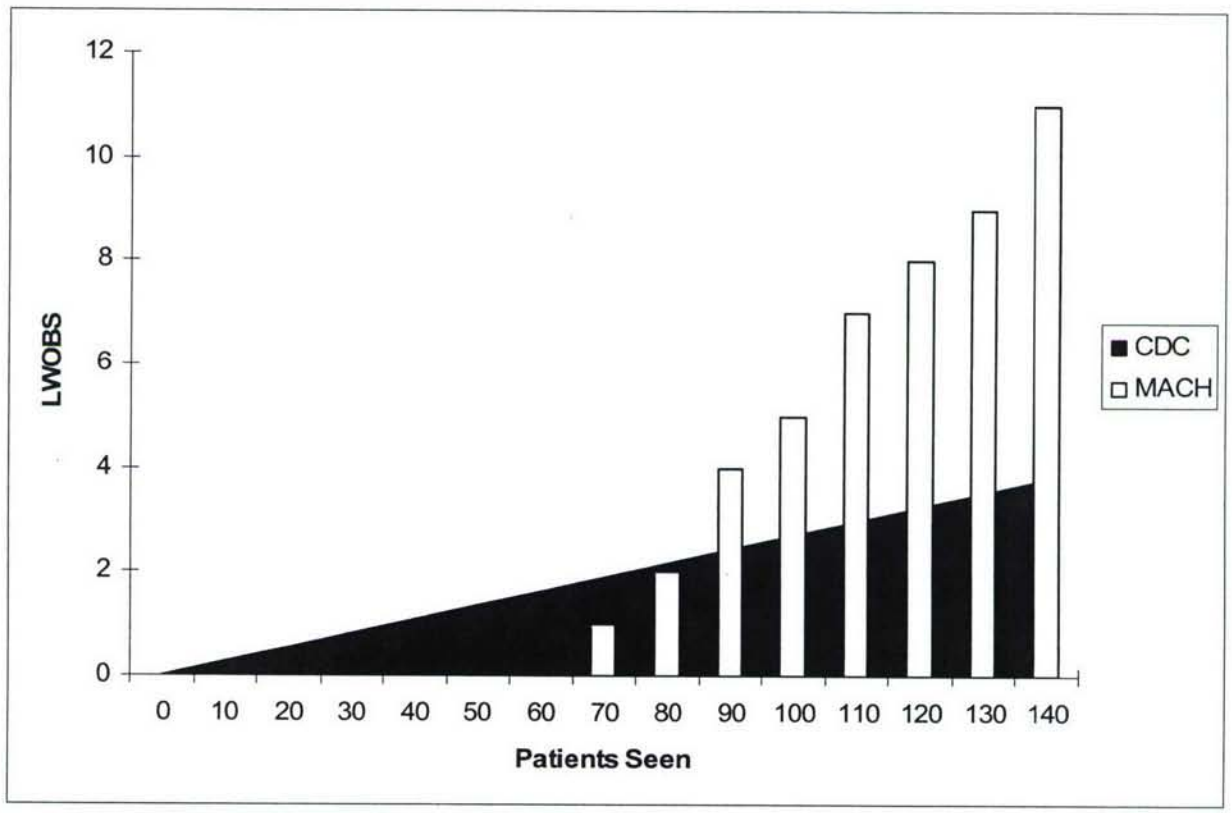

Figure 3: LWOBS and Patients Seen (Bar graph determined by equation Y=-8.78+0.14x).

Appendix J

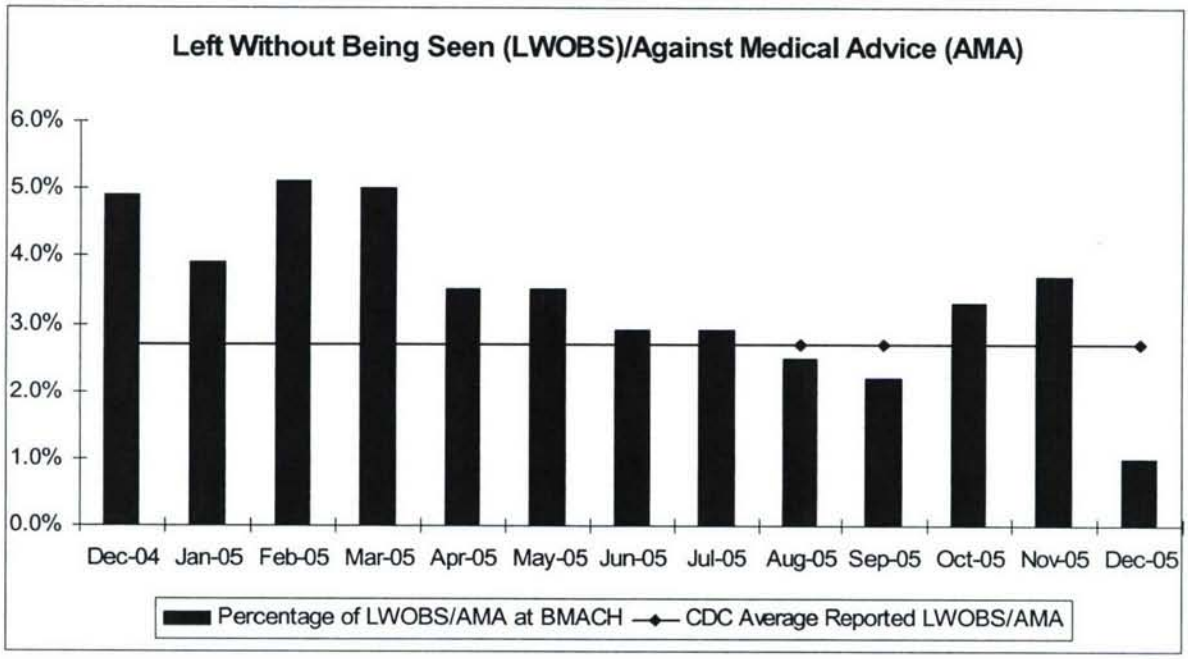

Figure 4. LWOBS/AMA from December 2004 to December 2005

Appendix K

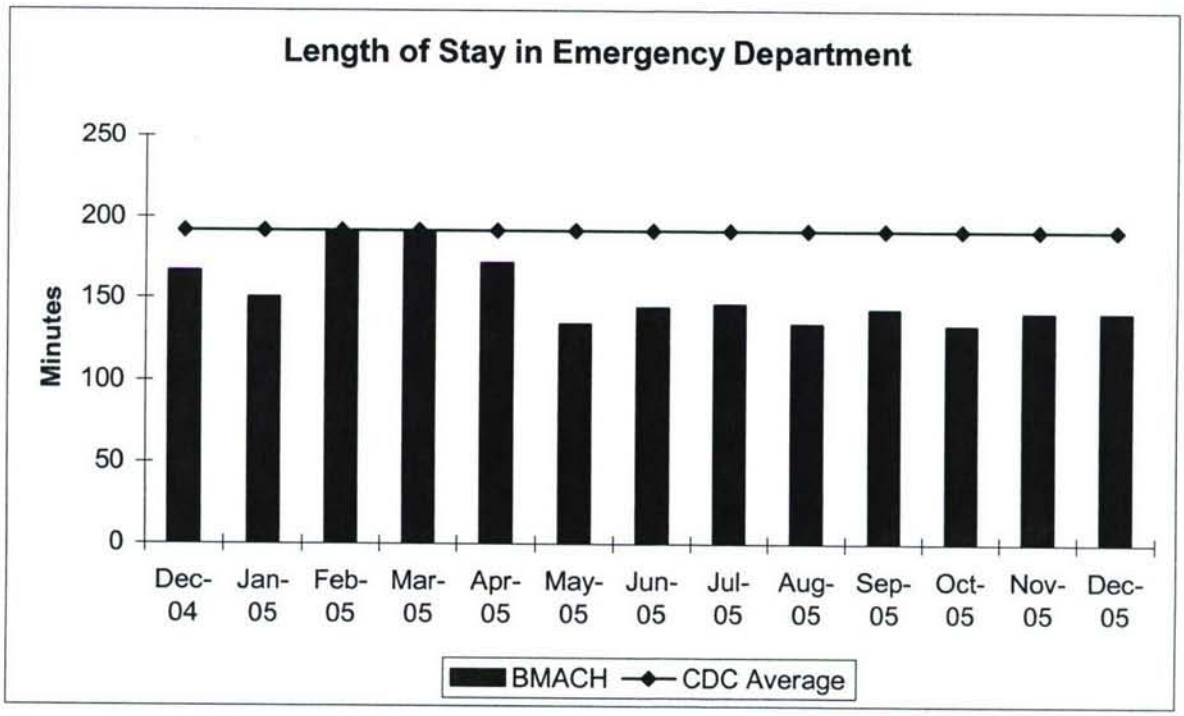

Figure 5. LOS in the ED from December 2004 to December 2005